marked as the marine evidence is in Suffolk, this evidence is entirely wanting further inland, and we have only levels, superposition, and structure to rely on in correlating the fragmentary outliers into which these beds finally resolve themselves. Again on the coast of the Eastern Counties, this group forms a nearly level plain but little above the sea-level, resting everywhere on an undisturbed or very slightly eroded bed of Chillesford Clay, and being succeeded, with but slight evidence of denudation, by the Lower Boulder Clay, or by the Glacial sands and gravel; whereas, as it trends inland, it attains a considerable elevation above the sea-level, passes unconformably over the older Tertiary strata, and has been subjected to a great amount of denudation. On the other hand, the old land, which seems to have extended from the eastward as far as the Norfolk coast, is now in great part below the level of the German Ocean. Further, whereas the succeeding Glacial beds all show a drift from northward to southward, this is the only case that has come under the author's notice of a marine drift from southward to the northward. The Westleton Beds, in their more typical aspect, consist of quartzose sands full of flint pebbles, almost as much worn and as numerous as in the Lower Tertiary sands of Addington. The author then proceeds to trace the beds through Essex, and gives a series of railway sections showing these beds, exhibiting usually the appearance of a white gravel, with intercalated ochreous beds, and reposing on a very eroded surface of the London Clay. In traversing the beds farther westward they undergo further modification. Certain characters remain, however, persistent, and on these we have to rely: (1) The shingle is composed essentially of chalk flint pebbles, becoming less worn as we approach the southern limits of the deposit; (2) it often becomes much mixed with flint pebbles and sub-angular fragments of compact sandstone derived from the underlying Tertiary strata; (3) the chert and ragstone fragments often so increase in numbers as to constitute a large portion of the gravel. They are worn and sub-angular, and the chert is identical with the chert of the Lower Greensand of Kent and Surrey; (4) the pebbles of white and rose-coloured quartz, of Lydian stone, and of white quartzite become rarer, and in places are wanting. The Lydian stone and some of the small quartz pebbles may be derived, with the chert, from the Lower Greensand, but this will not account for the great number of quartz pebbles found in the Eastern Counties. The quartzite pebbles are equally large, but lighter coloured and more ovoid than those of the New Red. They probably have drifted from a continental area on the east, the author having found similar beds in parts of Belgium; (5) the absence of northern drift. The author reserves for another occasion the description of the beds next in order; but he would mention here that the Boulder Clay and some Glacial gravels occupy in Herts and Berks a lower horizon than the Westleton Beds. It would therefore appear that, while the eastern area was submerged, and the strata followed in regular succession upon a surface which did not undergo denudation, the southern and western area was slowly elevated, and underwent partial denudation before the Upper Boulder Clay was deposited. Previous to the period of the Westleton and Mundesley beds, it is probable that the denudation of the Weald had hardly commenced. The area was spread over by Cretaceous strata under water at the beginning of the Crag period (the Lenham beds), and judging from the character of the beds which fringe the North Wealden area at Chelsfield, Cherry Down, &c., the author concludes that there was land south of this fringing shingle, whence the great mass of Chalk-flints and of Lower-Greensand cherts and ragstone must have been derived. This mass of *débris* serves to attest to the great extent of these strata that have been removed from the Wealden area while yet it was an elevated and not a depressed area. After the rise of the area over which the Westleton Beds extended, it underwent extensive denudation, and it was at this period that the great plain of the Thames Valley received its first outlines, although it was not until much later that the river valley received its last impress.

A Contribution to Seismology, by Prof. J. Milne and T. Gray, B.Sc.—It was pointed out that earthquake motion is generally of a very irregular character, that it usually begins gradually, reaches a maximum somewhat suddenly, and afterwards passes through several minima and maxima. The period of vibration of a great number of earthquakes observed by the authors varied between half and one-fifth of a second, while the total time of disturbance varied from one to three minutes. Reasons were given for believing that earthquakes which last for a long time are propagated further than those which last for a short time, even when the intensity of the latter is the greater. As to the determination of the origin of shock, the great value of accurate time observations was pointed out, and a sketch of different modes of making such observations was given. Explanations were entered into with regard to the rotation of bodies during earthquake shocks.

The Glacial Geology of Central Wales, by Walter Keeping, M.A.—The author adduces evidences to show that Central Wales was covered with snow and ice during the glacial period, but all the glaciers of which we have any traces were of strictly local character, each confined to its own drainage area in the present valley system. There is no evidence of any great *mer de glace*, nor of any marine submergence in recent geological times.

On the Lower Keuper Sandstone of Cheshire, by A. Strahan, M.A., F.G.S., Geological Survey of England and Wales.—This paper deals with some of the results of the re-survey of parts of Cheshire, which have been already described in detail in the Geological Survey Memoirs "On the Neighbourhood of Prescot" (third edition), and "On the Neighbourhood of Chester." Several sections, of which the best are at Runcorn and Frodsham, show that there is a strong and constant division between the waterstones and the Keuper Basement Beds. These were formerly classed together under the name of Lower Keuper Sandstone, but, so far as the re-survey has been carried, are now distinguished on the maps. The old and new classifications may be compared as follows:—

Old Classification.	New Classification.
Keuper Marl	Keuper Marl.
Lower Keuper Sandstone ...	Waterstones. / Lower Keuper Sandstone or Basement Beds.

SECTION D—BIOLOGY

Department of Anatomy and Physiology

On the Conario-hypophysial Tract, or the Pineal and Pituitary Glands, by Prof. Owen, C.B., F.R.S.—The author, referring to the latest contributions to the subject of his paper, remarked that they bore upon the functions of the so-termed "glands." Prof. Sapolini, in his work "L'Aire de la Selle Turcique" (8vo, 1880), concludes that "the pituitary gland secretes the fluid of the ventricles of the brain." Prof. Ed. Van Beneden, in reference to the supposed pituitary gland in Ascidians, regards it as their renal secretory organ (*Archives de Biologie*, 8vo, 1881). In pursuance of his aim, which was homological, Prof. Owen traced the modifications of the pineal and pituitary bodies and connecting parts from man down to the lowest fishes possessing a brain; and noted the progressively increased relative size and retention of tubular structure of the tract, including the so-called "pituitary gland," "infundibulum," "third ventricle," and "pineal gland," as the vertebrate series descended; also the further extension of the pineal part of the tract, beyond the brain, to its perforation of the cranium, leaving the so-called "foramen parietale" in some existing and in many extinct Reptilia. These phenomena were then tested and compared with concomitant phases in the development of the vertebrate, especially the mammalian, embryo. It was shown, as had been noted by previous embryologists, that prior to the permanent anterior outlet of the digestive sac, a production from such sac extended to the large cerebral vesicle, subsequently reduced to a "third ventricle"; whence the hollow tract was continued onward to the epithelial covering of the head, by which it was closed. The lower pharyngeal beginning of this trans-cerebral tract also became closed and modified as the "pituitary body." The upper continuation became modified, and in higher vertebrates closed as the "pineal body"; but the intermediate portion of the tract retained its primitive hollow condition as the "third ventricle" and "infundibulum." The "sella turcica" in mammals, like the "foramen parietale" in cold-blooded vertebrates, were modifications in the skeleton of parts of the "conario-hypophysial tract." This tract, under all its modifications, marked vertically the division between the "cerebrum" and the "optic lobes," or divided the "fore-brain" from the "hind-brain."

The author next proceeded to point out the homologies of the parts of the neural axis in invertebrates with those of vertebrates.

The so-called "supra-œsophageal ganglion or ganglions" in the former were homologous with the "cerebrum, or cerebral hemispheres" in the latter. The so-called "sub-œsophageal masses" in invertebrates answered to the mes-and ep-encephalic

masses in vertebrates. The neural chords and ganglions continued therefrom backwards in invertebrates, answered to, or were homologous with, the myelon or spinal chord of vertebrates, in which the ganglionic structure was more or less concealed, save in some fishes, by superadded neural substances.

Now the supra-œsophageal mass, or "fore-brain," in invertebrates is divided from the subœsophageal masses, or "hind-brain," by the production of a tubular portion of the fore part of the primarily closed alimentary cavity, which, extending between those parts of the neural axis, opens upon the surface of the head so attained, and there establishes the permanent mouth; the tubular extension therefrom similarly retains its functional or œsophageal relations with the alimentary cavity. The neural chords, connecting the so-separated "fore-brain" with the "hind-brain," traversed the sides of this gullet; as the chords or "crura," proceeding to expand into the "fore-brain" of vertebrates, traverse the sides or walls of that persistent part of the conario-hypophyseal tract known in anthropotomy as the third ventricle. The large relative size of the embryonal brain-vesicle in this connection is significative of the homology of the parts extending therefrom.

Passing next to the consideration of the characters which had been held to determine the "back" and "belly" of the animal, the author cited:—"Colour," the "relative position of the body of air-breathers to the ground they stood or moved upon,"[1] and the criterion, which Cuvier adopted to determine these aspects in the notable controversy with Geoffroy St. Hilaire in 1830.[2] That criterion was the cerebrum in vertebrates, and its homologue, the super-œsophageal ganglion, in invertebrates. In an enlarged copy of the diagram by which Cuvier illustrated his position, the author pointed out the grounds on which the great French comparative anatomist exclusively applied the term brain (*cerveau*) to this part of the cerebral centres; moreover, Cuvier expressly rejects the homology of the spinal cord of vertebrates with the ganglionic chord of the body in invertebrates; and he concluded that, however his opponent might turn about his articulate or molluscous subject, the so-called brain would be on opposite sides of the alimentary canal in the two groups compared.

Now, to reconcile this difference, the author pointed out that it only needs to add to Cuvier's diagram of the brain of the mammal the conario-hypophysial tract omitted in that diagram; and, if the facts and deductions in his paper were allowed to be valid, the actual difference would lie in the atrophy of the embryonal homologue of the invertebrate gullet and mouth in vertebrates, and the establishment in them of a new entry into the alimentary cavity.

In the vertebrate embryo this anterior entry makes its first appearance as a capacious branchial or water-breathing organ, and traces of this destination are determinable in the higher vertebrates, in which the respiratory function is ultimately other wise located and performed in relation to an aërial medium.

The entry to the alimentary cavity in Amphioxus is both a breathing and a feeding mouth: it is a vertical or longitudinal slit bounded by a pair of styles, in which is made the nearest approach to gristle of any part of the sclerous system in that primitive vertebrate. This "mouth" seems to be, or to be formed by, a confluent pair of the branchial openings, such as those which follow after it. To what pair of the costal, hæmal, or vertical side-walls or supports of the higher piscine vertebrate oral cavity, scapular, hyoid, tympano-mandibular, or palato-maxillary ribs, the parial styles of Amphioxus may be homologous, it is hard to say in the absence of skull or brain in that animal. In fishes the double function of the mouth is retained—all are "branchiostomous." In air-breathers the vertical entry becomes exclusively respiratory, and is more or less divided from the alimentary mouth beneath, and the opening or inlet to this becomes transverse by the production of the tympano-mandibular arch and its apposition to the palato-maxillary one above. In ancient forms of vertebrate air-breathers the entry to the narial passage, or respiratory mouth, as it may be termed, is by a pair of openings homologous with a piscine pair of branchial ones, but admitting air instead of water. To these "antorbital nostrils," as they are termed, in Plesio- and Ichthyosaurs, a more anterior single or confluent pair of inlets is added in Teleosaurs. In recent crocodiles the latter becomes exclusively the single, undivided, or partially divided breathing-mouth. In lizards and birds it is commonly divided, or there is a pair of "nostrils." In mammals the nostrils are commonly approximate. But the "feeding-mouth" remains below them as a distinct transverse cleft. In all these modifications the aperture, whether for breathing or feeding, or for both, is on the hæmal aspect of the brain; the vertebrates are hæmastomes; the invertebrates are neurostomes, and the chief part of their brain is "hæmad" of their mouth.

Returning to the criterion of the dorsal and ventral aspects of the animal body, the author maintained that the ganglionic body-chord in invertebrates did answer to the myelon of vertebrates; and adding this to the totality of the brain, the so-called "neural axis" was determined. So determined, he held that its position was the true criterion of the dorsal or neural aspect of the body, whether the animal moved with it next to, or farthest from, the ground, or neither the one nor the other, as in the human pedestrian.

The part or aspect of the body opposite the neural one was characterised by the location of the centre, or chief centres, of the vascular system, and this had led Prof. Owen, at the commencement of his anatomical teaching, to term it the "hæmal aspect."

Referring, finally, to the diagram of the invertebrate and vertebrate animals in corresponding positions, agreeably with the above criterion, the author showed that the so-called "brain" (Cuvier), or the supra-œsophageal brain-mass of comparative anatomy, was not above, but below, the mouth or gullet in invertebrates, and that the sub-œsophageal mass was above the mouth or gullet; also that the reverse relative positions were due to the atrophy of the primitive homologues of such entry in vertebrates, and the substitution of another opening or conduit to the stomach, whereby these anterior openings and conduits are on the lower or hæmal side of the cerebrum in vertebrates, on the upper or neural side of the cerebrum or fore-brain in invertebrates. In briefer terms, the one division was "hæmastomous"; the other division was "neurostomous." The paper was illustrated by drawings, of which enlarged diagrams were exhibited to the Section.

Dr. Montagu Lubbock's paper *On the Development of the Colour Sense* discussed the question of the evidence as to the acquirement of the power of perceiving colour by man within historical times, and also the question whether this perception had been gradually acquired by man or any animal at any time. He concluded that there were good grounds against believing that any such gradual development in the case of man could be proved; and while it was probable that in those animals which lived upon coloured food the power of appreciating colour would gradually arise, yet there was no proof of this yet available, and no idea could be given of the stages by which this had been brought about.

Prof. S. P. Thompson read a paper upon the *Function of the two Ears in the Perception of Space*, in which he stated his view as follows:—Judgments as to the direction of sounds are based in general upon the sensations of different intensity in the two ears; but the perceived difference of intensity upon which a judgment is based is not usually the difference in intensity of the lowest or fundamental tone of the compound sound, or "clang," but the difference in intensity of the individual tone or tones of the clang for which the intensity-difference has the greatest effective result on the quality of the sound. Prof. Thompson further remarked that now that the physical bases of the problem were laid down, the acoustic perception of space might be greatly elucidated by experiments upon persons possessed of abnormal hearing, and upon the blind, in whom this perception is abnormally developed.

Prof. J. C. Ewart of Aberdeen gave an account of the researches *On the Influence of Bacilli on the Production of Disease*, which he has communicated to the Royal Society.

Mr. W. A. Forbes read a paper *On the Incubation of the Indian Python* (*Python molurus*), *with special regard to the alleged Increase of Temperature during that Period*. This paper gave an account of a large series of observations made during the last season in the gardens of the Zoological Society. The python laid about twenty eggs, and incubated for about six weeks. Observations were made upon both male and female, kept in adjoining cages under conditions approximately identical, and it was found that there is an increase of temperature in the incubating female analogous to that which occurs in birds; the amount of increase observed was not so great as others had

[1] The anatomists who adopt this criterion call the hæmal aspect of the lobster its "back," the neural one its "belly"; the right side of the animal is its left side, and *vice versâ*.

[2] Reference was here made to the nineteenth vol. of the *Annales des Sciences Naturelles* for 1830 (March), p. 241, Pl. XII.

tated, being about 1·9° and 3° Fahrenheit, according as the temperature was taken on the surface of the body or between its folds.

Dr. D. J. Cunningham's paper *On the Structure and Homologies of the Suspensory Ligament of the Fetlock in the Horse, Ass, Ox, Sheep, and Camel*, described the particular members of the intrinsic group of muscles which enter into the formation of this ligament. He showed further that the process of transformation of muscle to ligament seemed to be effected by a fatty degeneration of the muscle-fibres with a coincident multiplication of the connective-tissue elements of the muscle; that muscular tissue may exist in the body and have no apparent function, unless it were a purposeless contraction, stimulated by the nerve-supply it received from nerves contained within the ligament. In the transformation the nerves remained unchanged; in the sheep, in which there is not a trace of muscular tissue left, the nerves were relatively as large as in the ox or horse.

Other papers were read, by Prof. Struthers, *On the Acetabulum of Animals in which the Ligamentum teres is described as wanting*, and *On the Correspondence between the Articulations of the Metacarpal and Metatarsal Bones in Man;* by Mr. F. M. Balfour, *On the Nature of the Pronephros, or so-called Head-Kidney of Adult Teleosteans and Ganoids;* by Mr. G. E. Dobson, *On the Digastric Muscle, its Modifications and Function;* and Dr. W. H. Stone, *On the Effect of the Voltaic Current on the Elimination of Sugar*. Altogether fourteen papers were read before this department, which only sat on two days. Half the papers were anatomical, and half physiological. It is to be assumed that the energies of anatomists and physiologists had been so largely occupied with the International Medical Congress that no novelties could be produced on this occasion.

Department of Anthropology

Miss A. W. Buckland, in a paper *On the Geographical Distribution of Mankind*, discussed the problems awaiting solution in anthropology, especially the relations of brachycephalic and dolichocephalic peoples, and the questions of the unity of the race, and of the peopling of oceanic islands and of Australia. She considered that nothing definite could as yet be determined regarding any of these matters.

Mr. Staniland Wake read a paper *On the Papuans and the Polynesians*, in which he came to the conclusion that the primitive stock from which both had sprung was now represented by the Australian race, which had formerly a much wider extension than at present. The existence of two types among the Australians showed they were not a pure race, being probably intermixed with the Negrito. The Polynesians showed considerable traces of this intermixture, while the Papuans had been largely affected by contact with a more modern Asiatic people now represented by the Malays, having been further specially influenced by the intermixture of Arab and Indian blood.

General Pitt-Rivers gave an account of *Excavations in the Earthwork called Ambresbury Bank in Epping Forest*, which showed that it was a camp of British erection, but it was not possible from the excavations made to determine whether it was made before or after the Roman conquest. General Pitt-Rivers read another paper *On the Entrenchments of the Yorkshire Wolds and the Excavations in the Earthwork called Danes' Dyke at Flamborough*, in which he showed that the term Danes' Dyke was undoubtedly a misnomer, for the whole district was the scene of the operations of a much earlier people, who were formidable in their means of offence and defence, and in the discipline necessary to construct the entrenchments, which extended for great distances. At Danes' Dyke he found both flints and flint flakes, showing that the defenders of the earthwork used flint, and lived not later than the bronze period, at the period of the tumuli of the Yorkshire wolds. In a further communication General Pitt-Rivers described his discovery of flint implements in stratified gravel in the Nile Valley, near Thebes.

Dr. Beddoe gave an interesting abstract of results *On the Stature of the Inhabitants of Hungary*, based on recruiting statistics. The average Hungarian soldier was about 5 feet 5⅜ inches high. The Germans and Croats gave taller men than the Magyars. The citizens of Budapesth were taller than countrymen at the age of twenty. In five western counties (including Pesth), where the population was mainly Magyar, the mean stature at twenty-five years might be taken as 5 feet 5·2 inches.

A paper *On the Physical Characters and Proportions of the Zulus*, read by Mr. Bloxam, gave the details of an examination of sixteen male and three female Zulus brought to this country, and measured in the presence of Prof. Flower, General Pitt-Rivers, Mr. Roberts, and Mr. F. Galton. It appeared that the average stature of the males was 67·3 inches, one-third of an inch less than the average Englishman of the same age. The average chest girth was 36·5 inches; Englishman's, 35 25 inches; average weight: Zulu, 151 lbs.; Englishman, 141 lbs. Of course the Zulus, being exhibited for their dancing and spear-throwing accomplishments, were in high training, and very well developed in muscle.

Mr. E. F. im Thurn, in a paper *On the Animism of the Indians of British Guiana*, dwelt at some length on the confusion introduced by the application to animism of the terminology and conceptions of higher religious systems. The Indians of Guiana had an animism of a very pure and primitive kind, very little affected by the modifications which change animism into higher religion. They had no belief in the everlasting duration of the spirit, no ideas corresponding to heaven, hell, and retribution, no knowledge of purely spiritual beings, *i.e.* gods, and no worship, though certain arts were practised to avoid attracting the attention of malignant beings.

Mr. Park Harrison, in exhibiting a collection of photographs of types of different races in the British Islands and in France, urged the necessity, for the purposes of scientific comparison, of having photographs taken of uniform size, both in full face, and sufficiently in profile to show the brow, the projection of the nasal bone, and also the form of the ear, which appears to be a racial characteristic, though much disguised by mixture of blood. This, however, would be attended with expense greater than the Anthropometric Committee could afford. Prof. Flower, in commenting on this communication, said the subject had scarcely yet been fairly attacked in this country; it was only by the photographing of numbers in each part of England that they might ultimately have a chance of arriving at the types of the principal races that had contributed to the mixtures now prevailing. There was great difficulty in forming an opinion as to what types people really represented; no doubt the comparison of photographs, done on a certain scale, would be of much value in this matter.

The Anthropological Department sat on five days, and thirty-seven papers or reports were presented to it. Among others that we may particularise as of interest were those by Mr. J. R. Mortimer, *On Six Ancient Dwellings found near to British Barrows on the Yorkshire Wolds;* Mr. Francis Galton, *On the Application of Composite Portraiture to Anthropological Purposes;* Mr. J. Harris Stone, *On the Viking Ship discovered at Sandefjord, Norway, in* 1880; Mr. Hyde Clarke, *On the Early Colonisation of Cyprus and Attica, and its Relation to Babylonia;* Mr. H. Stopes, *On Traces of Man in the Crag;* Prof. T. McK. Hughes and Mr. A. W. Wynn, *On the Age of the Deposits in the Caves of Cefn, near St. Asaph, with special reference to the Date of Man's first Appearance in them.*

Department of Zoology and Botany

Sir John Lubbock's paper *On the Sense of Colour in Animals* first dealt with Bonnier's experiments on bees, and showed many fallacies in them, which were avoided in a series of his own observations recently made. He took slips of glass of the size generally used for microscopic work, and pasted on them slips of paper coloured blue, green, orange, red, white and yellow, and induced a bee to visit all in succession when covered by a plain slip on which was a drop of honey. Then the honeyed slips were removed, and the situation of the coloured glasses was changed; when the bee returned from the hive the order of its visits to particular colours was noted, and the result of 100 different experiments was that blue was the bee's favourite colour, then white, yellow, and green. The observations were varied in several different ways, with the same results. The question naturally arose, How then are there so few blue flowers? Sir John believed that all flowers were originally green, and that they have passed through stages in which they were white or yellow, while many have become red, and finally blue. This was supported by facts such as the following:—In Ranunculaceæ many simple open flowers, as buttercups, were yellow or white; while the blue delphiniums and aconites were of highly specialised form, and therefore probably of more recent origin. Among the Caryophyllaceæ the red and purplish species were among those with highly specialised flowers, while the simple flowers, as stellaria and cerastium, were mostly white. Among violets many of the most highly specialised forms were blue; the simpler ones yellow. In gentians, again, the deep-blue

species have long tubular flowers specially adapted to bees and butterflies, while the yellow gentian has a simple open flower with exposed honey. Sir John also described his experiments made on daphnias by illuminating a trough with an extended solar spectrum in such a way that after a given lapse of time he could isolate the portion of the trough illuminated by each principal colour, and count the number of daphnias in it. They appeared to have a very predominant preference for the red and yellow and greenish yellow and green. He also found, contrary to the conclusion of M. Paul Bert, that they clearly perceive the ultra violet rays.

Sir John Lubbock read a paper *On the Mode in which the Seed of Stipa buries itself in the Ground.*—One of the most interesting parts in botany, he said, was the consideration of the reasons which led to the different forms, colours, and structures of seeds; and it was, he thought, pretty well made out that a large proportion of those might be accounted for either as serving to protect the seed or to assist in its conveyance to a place suitable for its growth. If the seeds of trees fell directly to the ground it was obvious that very few of them would have a chance of growing. It was an advantage to them, therefore, of which many availed themselves, to throw out wings, in consequence of which the wind wafted them to a greater or less distance. Others, such as the whole tribe of nuts, being edible, were carried about by beasts and birds, and though some were sacrificed, others survived. Fruits, again, in consequence of their sweetness, were carried about by animals, which, after partaking of the fleshy portion, dropped the seeds themselves. Many seeds were covered with hooks, and thus, adhering to the wool of sheep and other animals, were carried to greater or less distances. Others, like those of our common dandelion, were provided with fairy parachutes, and were thus borne away by the wind. Others again, like some of the violets, geraniums, vetches, brooms, cucumbers, cardamine, oxalis, and others, had beautiful and varied contrivances, by which they actually threw the seeds to a distance, in some cases of more than 20 feet. Others, again, were enabled to penetrate the earth, and thus sow themselves in the ground. In one of our English clovers, *Trifolium subterraneum*, after the flower had faded, it turned downwards, and buried itself in the ground. The ground nut of the West Indies, and more than one species of vetch, had a similar habit. In the *Erodiums* or Crane-bills, the fruit is a capsule, which opens elastically, and as in the case of the allied geraniums, sometimes threw seeds to some little distance. The seeds themselves were spindle-shaped, hairy, and produced into a twisted awn. The number of turns on the awn depended upon the amount of moisture. Mr. Rowe, to whom they were indebted for an account of their mechanism and mode of action, said if a seed be laid upon the ground, it remained quiet as long as it was dry, but so soon as it was moistened the outer side of the awn contracted, and the hairs surrounding the seed moved outwards, the result of which was to raise the seed into an upright position. The awn then gradually unrolled, consequently elongating itself upwards, with the result that if it was entangled amongst any of the surrounding herbage, the seed was forced into the ground. A still more remarkable case was that of the *Stipa pennata*. The actual seed was small, with a sharp point, and with stiff short hairs pointing backwards. The upper end of the seed was continued into a fine twisted rod; then came a plain cylindrical portion attached at an angle to the corkscrew, and ending in a long and beautiful feather—the whole being about a foot in length. That end was supposed by Mr. Francis Darwin, to whom they were indebted for a very interesting memoir on the subject, to act very much in the same manner as that of *Erodium*, already mentioned. He did not doubt that the end would bury itself in the manner described by Mr. Darwin, but he doubted whether it always did so. One fine day, not long ago, he chanced to be looking at a plant of that species, and around it were several seeds more or less firmly buried in the ground. There was a little wind blowing at the time, and it struck him that the long feather awn was admirably adapted to catch the wind, while on the other hand it seemed almost too delicate to drive the seed into the ground in the manner described by Darwin. He therefore took a seed and placed it upright on the turf. The day was perfectly fine, and there could therefore be no question of hydroscopic action. Nevertheless, when he returned after a few hours, he found that the seed had buried itself some little distance in the ground. He repeated the observation several times, always with the same result; thus convincing himself that one method, at any rate, by which seeds bury themselves is by taking advantage of the action of the wind, and that the twisted position of the awn, by its corkscrew-like movement, facilitates the entry of the seed into the ground.

Mr. A. W. Bennett read a paper *On the Constancy of Insects in Visiting Flowers*. He said he was not aware that attempts had yet been made to determine the question whether insects were altogether discriminating in their visits to flowers, or whether on the same journey they confined themselves exclusively or chiefly to one species. That paper, which was the result of observations during the fine weather of the last two years, was intended as a contribution towards the settlement of that question, obviously one of some importance in relation to the cross fertilisation of flowers by insects. Those who had not made the experiment would hardly appreciate how difficult it was to watch continuously for any considerable period the flight of any insect. He had chosen in all cases as points of observation spots where a considerable number of different flowers grew in profusion, and were intermixed, so that the insect would have abundant opportunity of changing its diet if so disposed. In recording the number of flowers of the same kind visited by an insect in the same flight, he always meant flowers at such a distance from one another that the insect had to use its wings in getting from one to another. In August of last year he observed three different flights of the "painted lady" butterfly, and it settled six, three, and ten times respectively, always confining itself to the same species of flower. On the same plot a hive-bee paid nine successive visits to the same species of flower. On another plot a bumble-bee visited the same species of flower fifteen times, and another of the same species eleven times in succession, not touching any other flower, but passing over many. Mr. Bennett gave further results of his observations on different occasions and in different parts of the country. In order to test whether insects were guided by colour only when visiting flowers, he watched one spot where there were white and purple foxgloves, but a large bumble-bee was seen to enter sixteen of the flowers regardless of colour, although to find the succession of foxgloves it had to fly considerable distances over other flowers. No general statement could be made as to the consistency of insects in visiting the same species of flower during the same flight. A decided preference for successive visits to the same flower was unquestionably shown in many instances, but those visits did not depend on the colour of the flower only. The hive-bee appeared to be by far the most constant in that respect, often absolutely so. From their strong and rapid flight and extremely hairy covering of their abdomen, that class of insects was probably the most efficient agent in the dissemination of pollen. So far as could be gathered from observation, the "painted lady" and the small tortoise-shell butterflies were very consistent, while the whites, the blues, and the browns were far from catholic, or less discriminative in their tastes. It was open to question, however, whether more than a very few flowers were dependent upon butterflies for their fertilisation. At all events their visits to flowers were often only interludes in their settlements on grass, leaves, the stems of trees, or the bare ground.

Prof. O. C. Marsh of Harvard, U.S., contributed one of the most attractive papers to this department, *On Jurassic Birds and their Allies*. He detailed the results of his examination of the Archæopteryx in the British Museum, the more recently discovered specimen at Berlin, and of Compsognathus in the Munich Museum, as compared with the forms previously made known by himself in America. His impression was that the two specimens of Archæopteryx were specifically identical, although fuller evidence might prove them to be distinct. He still considered that we knew little that could determine how or at what period birds originated. At present the four oldest known birds were as distinct from one another as any birds of the present day. Yet if he were asked to distinguish between the bones of a reptile such as Compsognathus and a bird such as Archæopteryx, if broken up and mixed together, he should be puzzled to do it. Prof. H. G. Seeley, in the subsequent discussion, stated his belief that the British Museum Archæopteryx was not merely specifically, but generically distinct from that at Berlin.

Dr. A. A. W. Hubrecht of Leyden gave an interesting exposition of *The Structure and Affinities of Proneomnia*, one of the valuable finds of the *Challenger* Expedition. Dr. Hubrecht spoke in excellent English, and was listened to with much appreciation.

Mr. Forbes gave an account of his work *On the Anatomy ana*

Classification of the Petrels, based upon those collected by the *Challenger* Expedition. He divided them into two main families —the Oceanitidæ or Oceanic Petrels, with four genera and seven species, and the Procellariidæ, divisible into three sub-families of albatrosses, diving petrels, and true petrels. As to descent, he considered the petrels were probably much modified descendants of some ancient form related to the ciconiform birds of Garrod, *i.e.*, the storks, American vultures, and their allies. Mr. P. H. Carpenter, M.A., read papers *On the various Larval Forms of Comatula*, and also *On the Species of British Comatula*. Other zoological papers of interest were by Prof. Busk *On the Use of the Chitinous Appendages of the Skeleton in the Cheilostomatous Polyzoa in the Diagnosis of Species;* Mr. W. T. Blanford, F.R.S., *On our Present Knowledge of the Fauna Inhabiting British India and its Dependencies;* Mr. P. A. Geddes, *Notes on Chlamydomyxa*, and *On a New Sub-Class of Infusorians;* Gen. Sir J. E. Alexander, *On the Improvement of Freshwater Fisheries*, and a further report was made *On the Marine Zoology of South Devon*.

Among other botanical communications we may note those of Mr. J. G. Baker, F.R.S., *On the Botany of Madagascar;* of Mr. A. W. Bennett *On the Colours of Spring Flowers;* of Mr. Joseph Lucas *On some Vestiges of the Ancient Forest of Part of the Penine Chain*. The department sat during five days, and twenty-eight communications were disposed of, including twenty zoological and eight botanical; the latter, however, fully divided the interest with the former, owing mainly to the papers of Sir John Lubbock and Mr. Bennett.

NOTES

DR. RUDOLPH KÖNIG of Paris, whose acoustical fame is world-wide, is about to publish in one volume, in the French language, his remarkable researches in acoustics, which have appeared at intervals in the *Annalen der Physik* and elsewhere, during the past fifteen years. The work will, we understand, be liberally illustrated with drawings of the newer and more important pieces of apparatus which Dr. König has invented.

M. PASTEUR, it is stated, has resolved to visit the Bordeaux lazaretto to study yellow fever, and ascertain whether it is due to a parasite, and can be guarded against by inoculation.

THE building of the Observatory of the Pic du Midi has been completed on the very top of the mountain, at an altitude of 2600 metres. The old building, which was placed in a valley at a less elevated situation, will be used merely as a station for travellers. General Nansouty is now busy fitting the establishment with apparatus and victuals for next winter, as, according to every probability, it will be blocked by snow during more than six months. The storms are so heavy that not less than six electric light conductors have been established for protection.

THE autumn meeting of the Iron and Steel Institute will be held in London this year, on October 11–14, at the Institute of Civil Engineers, under the presidency of Sir Henry Bessemer, F.R.S. Numerous excursions have been arranged for, and the following papers are announced to be read:—On the manufacture of steel and steel rails in the United States (supplementary paper), by Capt. W. R. Jones, Pittsburg, Pa.; on a method of securing homogeneity in the Bessemer process, by Mr. W. D. Allen; on the manufacture of ordnance at Woolwich, by Col. Maitland; on the application of wrought iron and steel to the manufacture of gun carriages, by Mr. H. Butter; on the manufacture of projectiles, by Mr. J. Davidson; on the distribution of elements in steel ingots, by Mr. G. J. Snelus; on the use of brown coal in the blast furnace, by Prof. P. Ritter von Tünner, Leoben, Austria; on certain physical tests and properties of steel, by Mr. Edward Richards; on the tin-plate manufacture, by Mr. Trubshaw; on the use of American anthracite in the blast furnace, by Mr. J. Hartman, Philadelphia; on variation of elements in cast-steel ingots, by Mr. F. Stubbs; and on the recent progress of the basic Bessemer process, by Herr Paul Kupelweiser, director of the Witkowitz Works, Austria.

GREAT preparations are being made in Dublin for the forthcoming meeting of the Social Science Congress, which begins its sittings there on the evening of Monday, October 3, when Lord O'Hagan, as president, will deliver the inaugural address in the Exhibition Palace. Among the other addresses to be given are the following:—"On Education," by Sir Patrick J. Keenan, K.C.M.G., C.B.; "On Health," by Dr. Cameron, M.P.; "On Economy and Trade," by Mr. Goldwin Smith; and "On Art," by Lord Powerscourt. During the week garden parties and *conversazioni* will be given by some of the leading citizens and learned societies.

BARON MIKLUHO MACLAY, before leaving Sydney, gave to the Linnean Society of New South Wales on July 25 a short account of the progress of the Sydney Biological Station at Watson's Bay, which has been opened through his energies, and of which we recently gave some account. The building was to be ready in a week's time, Dr. Maclay stated. The Royal Society of Victoria have agreed to assist the establishment of the station, not only by personal subscription, but also by an annual grant from the funds of the Society. This last decision is most important, opening the prospect of a permanent, if moderate, subsidy for the support of the institution. The Royal Society of New South Wales will also probably, on the representation of the President at the last annual meeting, follow a similar course. "I entertain the hope," Dr. Maclay said, "that the establishment of the Biological Station of Sydney will very probably induce the other colonies to follow this good example, and will be the means of uniting the scientific societies of different colonies. That the Biological Station of Sydney will not remain long isolated in this part of the world is a fact, as Dr. Hector told me that he intended to establish one in New Zealand. The establishment of an Intercolonial Biological Association, which should have for its object to assist in the formation, maintenance, and regulation of biological stations in Australia, was a plan which, in my opinion, ought not to remain long a *pium desiderium* only. Therefore I called a public meeting, June 15, with the object—1. To obtain a number of yearly contributors, as the subsidy from the Government is in proportion to the public subscription, and the yearly subsidies from the Royal Society of New South Wales and Victoria are very moderate. 2. To frame rules for the station. From the gentlemen present at the meeting a committee was chosen for the discussion of the proposed rules, this committee consisting of six members, of which four are at the same time trustees of the Biological Station; after four meetings, agreed to a code of rules, which will be submitted to the trustees of the Biological Station." Certainly science in Australia is greatly indebted to the intelligent energy of the Russian naturalist, and we trust the work so well begun will be continued without abatement.

THE Epping Forest and County of Essex Naturalists' Field Club's annual Cryptogamic meeting is advertised for Saturday, October 1. The Club is to be congratulated for the list of well-known botanists who appear as referees and conductors. Thus for Fungi we see the names of Dr. M. C. Cooke, M.A., F.L.S., Mr. Worthington Smith, F.L.S., Dr. H. T. Wharton, M.A., F.L.S., and Mr. James English; whilst for Mosses and Lichens the names of Dr. Braithwaite, F.L.S., and Mr. E. M. Holmes F.L.S., are announced.

THE Yorkshire Naturalists' Union will have a Fungus Foray on Friday and Saturday, September 30 and October 1, at which they will gladly welcome any mycologists who may be disposed to assist them. The Friday's programme is to consist of an excursion in the neighbourhood of Harrogate. On the Saturday is to be a "show," at which will be exhibited fungi, and any objects illustrative of the subject which may be sent. The dinner is to be on the evening of Saturday. Arrangements are being made to search localities in all parts of Yorkshire for specimens to exhibit; and at the meetings the Union will be